/PAL III REVISED AS OF
/15 NOVEMBER 1966

```
/PAGE 1
/PAGE ZERO CONSTANTS AND STORAGE
/INCREASE TIME-OUT DELAY TO ACCOMODATE PHOTO-ELECTRIC READER
*1
WAIT,   0
        TAD M2
        DCA 14
        ISZ 14
        JMP .-1
        ISZ WAIT
        JMP I WAIT
/INDIRECT REFERENCE TABLE
*20
AAA,    0               /POINTER TO READ ROUTINE
BBB,    0               /POINTER TO PUNCH ROUTINE
DDD,    0               /POINTER TO TYPE ROUTINE
SPECI,  SPSHUL          /SPECIAL CHARACTER HANDLER
NCHEKI, NCHEK           /CHARACTER TYPE PROCESSOR
CHEKI,  CHEK            /CHECKS CHARACTER LEGALITY
SYMCMI, SYMCOM          /SYMBOL COMPARISON ROUTINE
PUNI,   BINP            /BINARY PUNCH ROUTINE
EEE,    ALFO            /ALPHA OUTPUT ROUTINE
OCTI,   OCTO            /OCTAL OUTPUT ROUTINE
NUMBI,  NMBR            /OCTAL NUMBER PROCESSOR
SPACI,  SPACE           /SPACE HANDLER
CARRI,  CARR            /CARRIAGE RETURN HANDLER
DOLLI,  DOLLAR          /END-OF-PASS ROUTINE
STARI,  STAR            /ORIGIN HANDLER
ADDI,   ADD             /SET SIGN FOR ADD
SYMSTI, SYMSTO          /COMMA HANDLER
SUBI,   SUB             /SET SIGN FOR SUBTRACT
POINTI, POINT           /PERIOD PROCESSOR
EQUALI, EQUAL           /PARAMETER ASSIGNMENTS
FFF,    CSYM            /MAIN EXPRESSION HANDLER
PUSHJI, PUSHJM          /PUSHJ ROUTINE
POPJMI, POPJMP          /POPJ ROUTINE
PUSHI,  PUSHIN          /PUSH ROUTINE
POPMI,  POPM            /POP ROUTINE
LDTI,   LDTR            /LEADER-TRAILER GENERATOR
LOPUNI, LOPUN           /ASR 33 PUNCH
HIPUNI, HIPUN           /75 A PUNCH
LOREDI, LOREAD          /ASR 33 READER
HIREDI, HIREAD          /750 READER
IORIN,  IOR             /POINTER TO INCLUSIVE OR ROUTINE
NEXI,   NXPA            /POINTER TO NEXT PASS
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/PAGE 2
/NUMERICAL CONSTANTS
C2,     0002
C3,     0003
C4,     0004
C5,     0005
C6,     0006
C200,   0200
C211,   0211
C214,   0214
C215,   0215
C377,   0377
C4TH,   4000

M2,     -0002
M3,     -0003
M12,    -0012
M23,    -0023
M4,     -0004
M17,    -0017
M215,   -0215
M200,   -0200
M1,     -0001
M6,     -0006
M211,   -0211
M212,   -0212

/TEMPORARY REGISTERS

ITEM,   0               /USED BY INCLUSIVE OR ROUTINE
TEM5,   0               /USED BY EQUAL ROUTINE
TEM1,   0               /AVAILABLE TO ALL ROUTINES
TEM2,   0               /...
TEM3,   0               /...
POPTEM, 0               /USED BY PUSH,POP,ETC
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/PAGE 3
/SYMBOLIC CONSTANTS AND POINTERS

IAM1,    SYTA-1          /USED FOR AUTO-INDEX REGISTERS
PAGE,    7600            /MASK FOR PAGE BITS
CRLF,    4543            /CONSTANT FOR CR,LF
MASK,    3777            /MASKS OFF UNDEFINED BIT
SL3,     0007            /MASK FOR THREE BIT OCTAL #
SL7,     0177            /MASK FOR SEVEN BIT ADDRESS
SL6,     0077            /MASK FOR 6-BIT ALPHA CHAR
SF2,     6000            /MASK OFF PASS BITS
RBGN,    0               /BEGINNING OF READER BUFFER
RKON,    -574            /SIZE OF READER BUFFER
P1BGN,   PSHLST          /BEGINNING OF PUSHDOWN LIST
P1END,   -PSHLST-10      /CONSTANT FOR PDL OVERFLOW
TBUF,    7450            /BEGINNING OF PASS 3 BUFFER
GOREAD,  6650            /BUFFER WITH HIGH SPEED READER
C400,    0400            /INDIRECT BIT
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/PAGE 4
/DATA REGISTERS

PF,     0               /PASS FLAG
SPNT,   0               /POINTER TO END OF SYMBOL TABLE
CHAR,   0               /CURRENT CHARACTER BEING PROCESSED
INFO,   0               /INFORMATION FLAG
BINW,   0               /12 BINARY ASSEMBLED WORD
OCWD,   0               /12 BIT OCTAL WORD
AACT,   0               /ABSOLUTE ADDRESS COUNTER
ADDR,   0               /12 BIT ASSEMBLED ADDRESS
SYMVAL, 0               /OCTAL VALUE OF SYMBOL
SYM1,   0               /FIRST TWO CHARACTERS OF 6-LETTER SYMBOL
SYM2,   0               /2ND TWO CHARACTERS
SYM3,   0               /3RD TWO CHARACTERS
CKSM,   0               /CURRENT BINARY CHECKSUM
INSF,   0               /INSTRUCTION FLAG; 1 IF INSTRUCTION
ZFLG,   0               /Z FLAG; 1 IF PAGE ZERO REFERENCE
FLAG,   0               /COMMENT FLAG; 1 IF IN A COMMENT
SIGN,   0               /SIGN ASSOCIATED WITH PRESENT ATOM
TYPE,   0               /SYMBOL TYPE
SWITCH, 0               /END-OF-TAPE FLAG
RCNT,   0               /NUMBER OF CHARACTERS LEFT IN BUFFER
PSHPN1, 0               /PUSH DOWN POINTER

/75A PUNCH ROUTINE
/LENGTH: 6 REGISTERS
HIPUN,  0
        PSF
        JMP .-1
        PLS
        CLA             /EXIT WITH C(AC)=0
        JMP I HIPUN
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/PAGE 5
/PARAMETER ASSIGNMENTS

PUSHJ=JMS I PUSHJI
POPJ=JMP I POPJMI

AUTOA=10
AUTOB=11
AUTOC=13

SORT1=16
SORT2=17

POP=JMS I POPMI
PUSH=JMS I PUSHI

/DECIMAL AND OCTAL PSEUDO-OPS
/TO SET CURRENT RADIX
/LENGTH : 8 REGISTERS

DECMA,  TAD INST1       /NOP INSTRUCTION
        DCA I SWTCHN    /STORE IN SWITCH
        POPJ
OCTALP, TAD INST2       /SKP INSTRUCTION
        JMP .-3                 /STORE AND EXIT
INST1,  NOP
INST2,  SKP
SWTCHN, NSWTCH          /LOCATION IN "NMBR"
C204,   0204
L00,                    /END OF PAGE MARKER
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/PAGE 6
/BEGINNING OF PAL
/DETERMINES TYPE OF I-O TO BE USED
/CALCULATES PASS NUMBER FROM SWITCH SETTINGS
/LENGTH: 35 REGISTERS
*200

SPAL,   DCA TEM1                    /0 TO COUNTER
        PLS                 /SELECT PUNCH
        RFC                 /SELECT READER
        RSF                 /READER FLAG SET?
        JMS WAIT
        JMP HREAD           /YES: HIGH READER INPUT
        ISZ TEM1                    /WAITED ENOUGH?
        JMP .-4                     /NO: TRY AGAIN
        TAD LOREDI          /YES: LOW SPEED READER
        DCA AAA
        TAD TBUF                    /ALL OF CORE FOR SYMBOLS
        DCA RBGN
TPUN,   DCA TEM1                    /0 TO COUNTER
        PSF                 /PUNCH FLAG SET YET?
        SKP                 /NO
        JMP SHIPUN          /YES: HIGH SPEED PUNCH
        ISZ TEM1                    /WAITED ENOUGH?
        JMP .-4                     /NO: TRY AGAIN
        TAD LOPUNI          /YES: LOW SPEED PUNCH
        DCA BBB
PASS,   KCC                 /INNITIALIZE DEVICES
        TLS
        PLS
        CLA OSR
        AND SF2                     /WAS PASS NUMBER SET?
        SNA
        JMP NXPA                    /NO, HALT
        RAL CLL                     /GET HIGH ORDER BIT
        SNL                 /WAS IT SET?
        JMP PASS1           /NO, PASS 1
        SMA CLA                     /YES, WHAT ABOUT LOW ORDER?
        JMP PASS2           /NOT ON, PASS 2
        JMP PASS3           /ON, PASS3
NXPA,   HLT
        JMP PASS
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```
/PAGE 7
/HREAD; HIPUN
/ROUTINES TO SET POINTERS FOR READ AND PUNCH
/LENGTH: 6 REGISTERS


HREAD,  TAD HIREDI
        DCA AAA
        TAD GOREAD
        JMP TPUN-1
SHIPUN, TAD HIPUNI
        JMP PASS-1
/POPJ ROUTINE TO EXIT RECURSIVELY FROM SUBROUTINES
/CHECKS FOR PUSHDOWN UNDERFLOW VIA POP ROUTINE
/LENGTH: 3 REGISTERS

POPJMP, POP             /GET RETURN ADDRESS
        DCA POPTEM      /STICK IT IN POPTEM
        JMP I POPTEM    /EXIT


/ROUTINES TO SET PASS FLAG AND APPROPRIATE POINTERS
/LENGTH: 13 REGISTERS

PASS1,  CLA             /SET PASS FLAG TO ZERO
        DCA PF
        TAD IAM1                /INITIALIZE SYMBOL TABLE POINTER
        DCA SPNT
        JMP INITAL      /GO INITIALIZE FLAGS,STORAGE
PASS2,  IAC             /SET PASS FLAG TO ONE
        DCA PF
        DCA CKSM                /CLEAR THE CHECKSUM
        JMS I LDTI      /PUNCH LEADER-TRAILER
        JMP INITAL      /INITALIZE FLAGS AND STORAGE
PASS3,  CMA             /SET PASS FLAG TO -1
        DCA PF
        JMS I LDTI      /PUNCH LEADER/TRAILER
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/PAGE 8
/INITIAL ROUTINE
/ROUTINE TO INITIALIZE FLAGS, BUFFERS, AND STORAGE
/LENGTH: 15 REGISTERS

INITAL, DCA SWITCH        /SET END OF TAPE SWITCH
        TAD TBUF                  /SET PASS3 BUFFER
        DCA AUTOC
        TAD P1BGN         /SET PUSHJ,POPJ BUFFER
        DCA PSHPN1
        CMA               /SET HIGH SPEED READER BUFFER
        DCA RCNT
        TAD C200                  /SET ORIGIN TO 200
        PUSHJ             /SET
        STAR+3            /AND PUNCH IF PASS 2
        TAD LOPUNI        /TYPE ON PASS 3
        DCA DDD
        DCA FLAG                  /COMMENT SWITCH
        PUSHJ             /SET RADIX TO OCTAL
        OCTALP
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/PAGE 9
/MAIN ROUTINE
/MAIN CALLS CSYM TO ASSEMBLE A LINE OF CODE
/AND DECIDES IF ANY PUNCHING OR PRINTING IS TO BE DONE
/AND WHETHER THE AACT SHOULD BE INCREMENTED
/LENGTH: 27 REGISTERS

MAIN,   DCA INSF                /CLEAR INSTRUCTION FLAG
        DCA ADDR                /CLEAR 12-BIT ADDRESS WORD
        DCA BINW                /CLEAR BINARY WORD
        DCA OCWD                /CLEAR OCTAL WORD
        DCA SYMVAL      /CLEAR SYMBOL VALUE
        DCA ZFLG                /CLEAR Z-BIT FLAG
        DCA INFO                /CLEAR INFORMATION FLAG
        DCA SIGN                /RESET SIGN TO "IOR"
        PUSHJ           /RECURSIVE CALL TO "CSYM"
        CSYM            /ADDRESS FOR PUSHJ HANDLER
        TAD PF          /WHICH PASS?
        SNA             /DON'T PUNCH ON PASS1 OR PASS3
        JMP MOUT                /PASS1, JUST RESET POINTERS
        SPA CLA                 /PASS 3?
        JMP I POUTI     /YES: ASSEMBLY LISTING
        TAD INFO                /NO,PASS 2, ANYTHING TO PUNCH?
        SNA CLA
        JMP MOUT                /NO, RESET FLAGS
        CLL             /CLEAR LINK FOR BINP ROUTINE
        TAD BINW                /GET ASSEMBLED BINARY WORD
        JMS I PUNI      /PUNCH IT
MOUT,   TAD INFO                /WAS THERE VALID INFORMATION ON THIS LINE?
        SZA CLA
        ISZ AACT                /YES,INCREMENT CURRENT LOCATION COUNTER
        NOP             /PREPARE FOR ASSEMBLING INTO 7777
        JMP MAIN                /GO BACK TO MAIN LOOP
POUTI,  POUT            /ADDRESS OF PASS 3 HANDLER
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/PAGE 10
/MAIN CHARACTER PROCESSOR
/GATHERS SYMBOLS ON A LINE-BY-LINE BASIS
/SYMBOLS MUST BEGIN WITH A LETTER
/LENGTH: 17 REGISTERS

CSYM,   DCA SYM1                    /CLEAR SYMBOL STORAGE WORDS
        DCA SYM2
        DCA SYM3
        JMS I AAA           /GET A LEGAL CHARACTER
        JMS I NCHEKI        /WHAT KIND OF CHARACTER IS IT?
        JMP I NUMBI         /NUMBER - GO PROCESS
        ISZ INFO                    /LETTER, INDICATE VALID INFORMATION
        TAD M2              /GET UP COUNTERS - 2 CHARS PER WORD
        DCA TEM1
        TAD M4              /AND 3 WORDS PER SYMBOL
        DCA TEM2
        JMP I GETSP         /GO PACK IT

NXCH,   JMS I AAA           /GET A LEGAL CHARACTER
        JMS I NCHEKI        /WHAT TYPE OF CHARACTER IS IT?
        JMP I GETSP         /NUMBER LEGAL NOW
        JMP I GETSP         /LETTER- GO PACK IT
GETSP,  GETS


/PAL PUNCH AND TYPE ROUTINE
/LENGTH:  LOPUN:     6 REGISTERS

LOPUN,  0
        TSF
        JMP .-1
        TLS
        CLA                 /EXIT WITH CLEARED AC
        JMP I LOPUN

/THE PAUSE PSEUDO-OP
/LENGTH: 5 REGISTERS
STOP,   HLT CLA                     /HALT
        DCA SWITCH          /RESET END-OF-TAPE SWITCH
        CMA                 /EMPTY READER
        DCA RCNT                    /BUFFER
        POPJ                /EXIT

L02,                        /END OF PAGE

        PAUSE
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